purpose of absorbing the maximum amount of carbon dioxide from the air, and in this manner it may be possible enormously to increase the amount of carbon which a given area of land will pick up. This may sound fanciful, but the wonderful improvements which hybridisation has effected in the past make it quite possible that in the future still greater improvements may be looked for.

A PRACTICAL HANDBOOK ON RUBBER.

Rubber Cultivation in the British Empire. By Herbert Wright. Pp. vi+100. (London: Maclaren and Sons, 1907.) Price 2*s*. 6*d*.

THIS is one of the most interesting and useful little books yet published on rubber cultivation, and should be in the hands of every planter. It is a reprint of a lecture delivered before the Society of Arts. The book is not only of great value to those interested in plantation rubber, but also to those interested in the development of wild rubber. Mr. Herbert Wright, who was at one time controller of the Government experimental station in Ceylon, is now the editor of the *India Rubber Journal*. He is also the author of one of our best standard works on rubber, viz. "Hevea Brasiliensis," which is a scientific treatise on the botany of rubber. The present publication is more in the form of a useful and practical handbook, and deals with the great potentialities of the rubber industry, and its importance from "the producer's standpoint, especially in British possessions."

The gradually increasing demand for raw rubber, and the remunerative prices obtained, have produced enormous developments in the past few years on Eastern plantations. At the present the most important centre for rubber collection is tropical America, which supplies about 60 per cent. of the world's output. Africa comes next with 30 per cent. to 35 per cent., but tropical Asia last year only contributed 3 per cent. Borneo, New Guinea, Fiji, New Caledonia, and the Seychelles are also commencing to develop a strong interest in rubber-producing plants.

"It may be safely stated," writes Mr. Wright, "that to-day there are no less than 14,000,000*l*. of English money represented as paid up capital in companies directly or indirectly concerned with rubber growing. Furthermore, it may be estimated that approximately 30,000,000*l*. worth of rubber may be consumed during the present year."

The natural order which supplies the greater part of the world's rubber is the Euphorbiaceæ, the most valuable species being the Hevea, which produces the well-known Para rubber which has been planted so extensively in Ceylon, Federated Malay States, Straits Settlements, and Sumatra.

Mr. Wright speaks with considerable authority and experience on plantation Para rubber, and he thinks that it will sooner or later obtain a prominent, if not the commanding, position as a source of future rubber; but this will not be for many years, for in speaking of wild rubber he says:—

"Should the supply from wild sources become scarce —an improbable occurrence—it would be impossible for the plantations to supply the balance for many years to come, as the producing capacity of the land now alienated for rubber in the East will only be in 1912 or 1913 some 12,500 to 25,000 tons per year. The rubber manufacturers have hitherto been dependent, almost entirely, on wild rubber; and it seems illogical to suggest that the rubber forests on which so much new capital and enterprise have been recently expended, and in which prominent scientific and business men are concerned, will be unable to satisfy the increased demand expected in the next few years. It may confidently be regarded as the principal source of rubber for the next half score of years, for the simple reason that plantations in the proper sense do not exist to produce what will be required."

At the end of the lecture there is an instructive discussion, in which Lieut.-Col. Prain, Mr. Gray, Mr. Fritz Zorn, and Mr. S. Figgis took part.

L. C. B.

OUR BOOK SHELF.

School Hygiene; a Handbook for Teachers of all Grades, School Managers, &c. By Herbert Jones. Pp. x+151. Dent's Mathematical and Scientific Text-books for Schools. (London: Dent and Co., 1907.) Price 2*s*.

THIS is one of the many books that the great movement towards school hygiene has thrown up. The book, or rather booklet, contains practically nothing that is new, but the selection of topics is done with judgment and care; every main subject of environmental hygiene is touched on with sufficient fulness to meet the needs of immediate practice or to provoke to further reading, and the illustrations are profuse and good. The author has succeeded in treating "the subject as simply as possible." The work of Dr. Kerr at the London County Council is largely drawn upon. As in Dr. Newsholme's "School Hygiene," the book is allocated half to the school and half to the scholar. In criticism, it may be said that rather much space is given to matters, *e.g.* site, building construction, and sanitary appliances, &c., that the teacher cannot alter or affect, and rather little space to what he can affect. But with this qualification the booklet forms a good introduction to the subject. The writing is well adapted to the intended readers.

Regeneration and Transplantation. By Prof. E. Korschelt. Pp. 286; 144 figures. (Jena: G. Fischer, 1907.) Price 7 marks.

OF recent years there has been much experimenting and not a little theorising regarding regeneration and grafting. The results of the experiments have sometimes been very remarkable and full of theoretical suggestiveness, and they are now so numerous that a general survey of their import is very welcome. We have already a volume on regeneration by Prof. T. H. Morgan which has been of great service; we have now an analogous volume by Prof. Korschelt. He traces the phenomena of regeneration through the world of organisms, in unicellulars and multicellulars, in plants and in animals, in young forms and full-grown forms, showing the varied distribution of the regenerative capacity and its varied expressions, and always returning to the central question, How has it come about, and by what precise processes does it come about, that a lost part is re-grown and the intactness of the creature restored? Special sections of the book are devoted to a discussion of such subjects as the following:—autotomy, often-repeated regeneration, restitutions and regulations, heteromorphosis, atavism in regeneration, imperfect and superfluous regeneration, the relation of the nervous system to

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regeneration, the relation of regeneration to nutrition, to reproduction, to age, and to environmental conditions. The author's exposition is lucid, and there is an illustration on every second page. In the second part of the book we find an account of grafting or transplantation in plants and in animals, with strange figures of grafted polyps and worms, pupæ and tadpoles, frogs and newts—an altogether quaint assemblage. At the end of the book there is an exhaustive bibliography, certainly amazing in its dimensions, very usefully subdivided into sections relating to different aspects of the subject. As to the general theory of regeneration, Prof. Korschelt seems to incline to a compromise between the views of Weismann and Morgan, admitting that there is a great deal to be said on both sides. He seems—for he is anything but dogmatic—to believe that the regenerative capacity is a primary quality of living matter, which, along certain lines of evolution, has been accentuated and specialised by natural selection. Thus the regenerative capacity is, in general, a primary quality, but in particular cases an adaptive character.

Organische Zweckmässigkeit, Entwicklung und Vererbung von Standpunkte der Physiologie. By Dr. Paul Jensen. Pp. xiii+251. (Jena: Gustav Fischer, 1907.) Price 5 marks.

Prof. Jensen has produced a book which attempts to deal in a philosophical manner with some of the most difficult problems that confront the biologist. The reader will perhaps be inclined to deprecate an attitude of "cock-sureness" that rather pervades the whole, but he will at the same time recognise that in many places the author is stimulating and suggestive.

A great part of the whole volume is devoted to the examination of the various explanations that have been put forward to account for adaptation in the organic world, as well as of those which have attempted to deal with the meaning and the method of evolution.

After a somewhat lengthy discussion of these topics, the author puts forward the analogies shown by various cosmic mechanisms to assume positions of relative or absolute stability, and he regards them as useful in throwing light on the problems of evolution. The whole of the constructive part of the book strikes us as very speculative, and though of undoubted interest, it may be doubted whether the point of view as advocated by Jensen will find much sympathy amongst working biologists. The title of the work indicates that it is written from the standpoint of physiology, but we have searched its pages in vain to find any serious physiology, as ordinarily understood, discussed in it at all. There is much philosophy of a sort, and much acute destructive criticism of many ideas and notions that are widely current. But it does not appear that in grappling with the problems he has set himself to face and to solve, the author has expressed himself so clearly as did Herbert Spencer many years ago. There is much in the work before us that recalls the "Principles of Biology," though there is a great difference between the lucid expression of Herbert Spencer and that of our author. The following passage, relating to the causes of extinction of species and genera in the past, will furnish a fair sample of the method of treatment:—"According to our theory of development, a *natural* extinction of species is to be anticipated as the expression of a general law. Organisms that are dying out in this way fall into the same category as those systems which, after enduring through a long period in a stationary condition, pass finally, as the result of slowly advancing changes, into a relatively stable state (death); a destiny that . . . in time will overtake many existing organisms, in spite of the 'rejuvenating' effects of amphimixis" (p. 237). J. B. F.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of Nature. *No notice is taken of anonymous communications.]*

The Windings of Rivers.

At the meeting of the British Association at Edinburgh in 1892 I read a paper on the subject of the winding of rivers before the geographical section. It was illustrated by a large number of diagrams, but, as these could not be included in the report of the meeting, only the title of the paper appeared. It may not be out of place to give a short account of it, as the subject is now attracting some attention.

In Fig. 1 the courses of three streams are shown. These are distinguished by the letters A, B, C, without indication of their identity or of the scale on which they are drawn. If anyone were to try to select the one which represents the largest or the smallest of these streams he might do so correctly, but he would not be surprised if he were told that he had guessed wrongly, for it could only be a guess. The length of each tracing is the same. In nature it represents in A nine English miles, in B two hundred and sixteen miles, and in C one and a half miles.

Tracing B represents the part of the Mississippi between the mouth of the Arkansas River and that of the Red River. Tracing A represents the Devon Water, a tributary of the Forth, and tracing C represents a quite insignificant brook called the Catter Burn, a tributary of the Endrick, one of the principal affluents of Loch Lomond. These tracings, and indeed the maps of all countries, show clearly the great family likeness exhibited by rivers in all parts of the world. This likeness rests on the fact that in all rivers the relation between the length of an arc or bow and that of its chord is nearly the same. It is an organic rather than a family likeness, and resembles that which exists between dogs of different breeds or builds.

The following table shows, for a selection of well-known rivers, the degree in which the above relation holds good:—

River on the stretch		Length of stretch		Ratio	Number of bows	Average length of bows
From	To	Direct	Along windings			
Mississippi		Miles	Miles			Miles
Columbus	Memphis	124	204	1·65	23	8·87
Memphis	Natchez	270	490	1·83	62	8·10
Natchez	Baton Rouge	88	133	1·51	18	7·39
Baton Rouge	Carrolton	72	124	1·72	20	6·20
Columbus	Carrolton	554	955	1·72	122	7·83
Thames						
Marlow	Walton	18·7	30·0	1·61		
Teddington	Isle of Dogs	16·8	26·5	1·58	11	2·4
Danube	Near mouth	11·4	22·5	1·97	13	1·73
Rhine		kilom.	kilom.			kilom.
Germersheim	Mannheim	34·1	69·2	2·03	11	6·3
Main		114	144	1·27	44	3·27
Neckar						
Heilbronn	Mannheim	80	112	1·40	26	4·30
Lahn						
O. Lahnstein	Limburg	17·2	29·7	1·73		
Mosel	Nr. Coblentz	7·0	10·0	1·43		
Ahr						
Altenahr	Ahrweiler	4·6	9 6	2·09		

From the table it will be seen that over a length of nearly one thousand miles of the Mississippi the average length of stream, following the windings, is 1·72 times greater than the direct distance. In the Lahn we find

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